JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXVII NO. 22 SAN FRANCISCO, NOVEMBER 25, 1916 PER COPY, 25 CENTS

PERIODICAL DIVISION LIBRARY OF CONGRESS NOV 29 1916

THE RUSH CREEK CONTROVERSY.
BY C. C. HOGAN.

ANALYSIS OF VARIOUS TYPES OF IRRIGATION PUMPS.
BY R. H. CATES.

THE INSTALLATION OF ELECTRIC HEATING APPARATUS.
BY E. A. WILCOX.

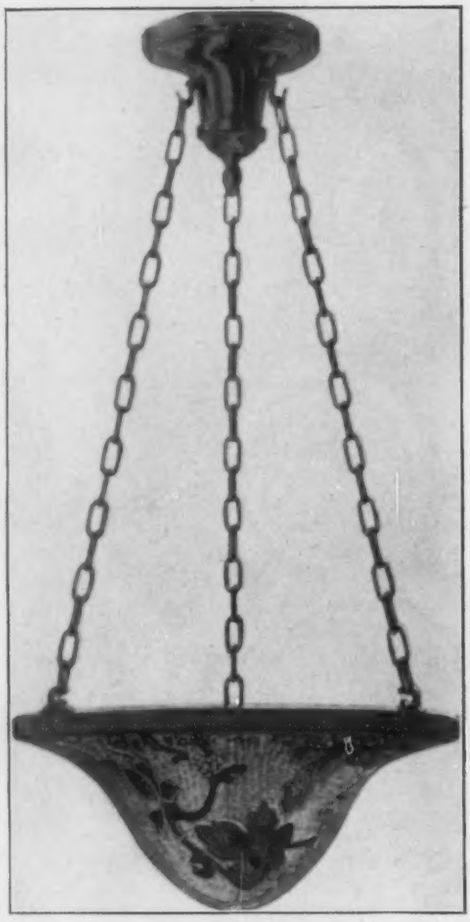
MATERIALS ADVERTISED IN THIS ISSUE

Batteries
Edison Storage Battery Co.
Battery Charging Equipment
Cutler-Hammer Mfg. Co.
Boiler Feed Water Treatment
Dearborn Chemical Co.
Circuit Breakers
General Electric Co.
Conduit Products
Baker-Joslyn Co.
Sprague Electric Co.
Electrical Supplies
Pacific States Electric Co.
Electric Ry. & Mfrs. Supply Co.
Transportation
Southern Pacific Co.
Insulators
Hemingray Glass Co.
Locke Insulator Mfg. Co.
Pierson, Roeding & Co.
Insulator Pins
McGlauflin Mfg. Co.
Lighting Fixtures
Pacific States Electric Co.
Motors
Western Electric Co.
Crocker-Wheeler Co.
Century Electric Co.
Oil Burners
Leahy Mfg. Co.
Piping
Pittsburg Piping & Equipment Co.
Schaw-Batcher Pipe Works.
Pole Line Hardware
Hubbard & Co.
Power Plants
Chas. C. Moore & Co.
Rotary Converters
Westinghouse Electric & Mfg. Co.
Signs (Electric)
Federal Sign System (Electric).
Theatre Dimmers
Ward Leonard Electric Co.
Turbines
Pelton Water Wheel Co.
Vacuum Cleaners
Hurley Machine Co.
Wire and Cable
The Okonite Co.
Wireless Apparatus
Haller-Cunningham Co.

Alphabetical Index to Advertisers, Page 8 Where to Buy It in the West, Page 9

THIS IS THE NEW

DECOLITE



No. 07540—$19.00 List Each

(Includes 14-inch glass bowls, 3 chains, canopy, Brush Brass Finish.) Does not include cloth insert—buy insert to match your draperies or wall paper and place between two glass bowls.

Write for discounts and catalogs showing other sizes and designs

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

LOS ANGELES OAKLAND PORTLAND
SAN FRANCISCO SEATTLE

Address our nearest house.

Boost Your Xmas Sales

with the

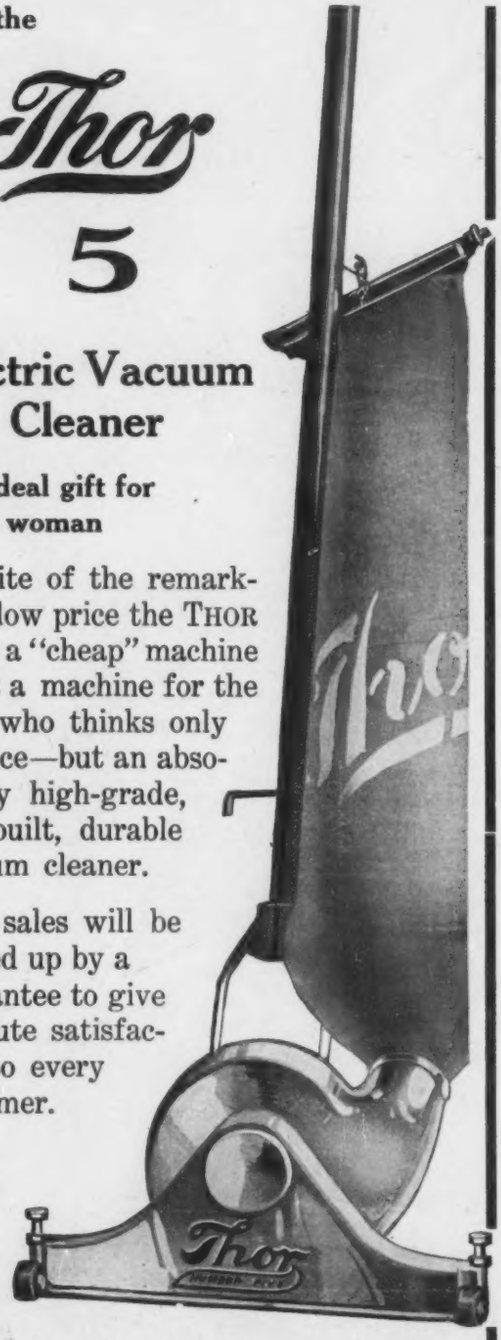
Thor 5

Electric Vacuum Cleaner

The ideal gift for every woman

In spite of the remarkably low price the THOR is not a "cheap" machine—not a machine for the man who thinks only of price—but an absolutely high-grade, well built, durable vacuum cleaner.

Your sales will be backed up by a guarantee to give absolute satisfaction to every customer.



Write today for particulars to our Pacific Coast Representatives

Hurley Machine Co.

Chicago New York

Distributers for the Pacific Coast

PACIFIC STATES ELECTRIC CO.

Los Angeles Oakland Portland
San Francisco Seattle

NOV

NOV 28 1916

©CLB370371

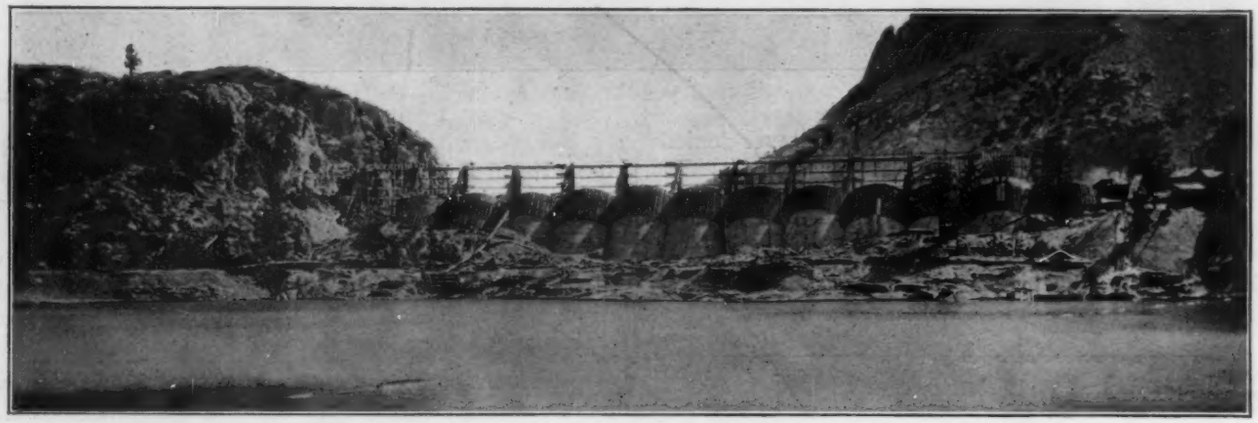
JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXVII SAN FRANCISCO, NOVEMBER 25, 1916 NUMBER 22

[COPYRIGHT 1916 BY TECHNICAL PUBLISHING COMPANY]

THE RUSH CREEK CONTROVERSY

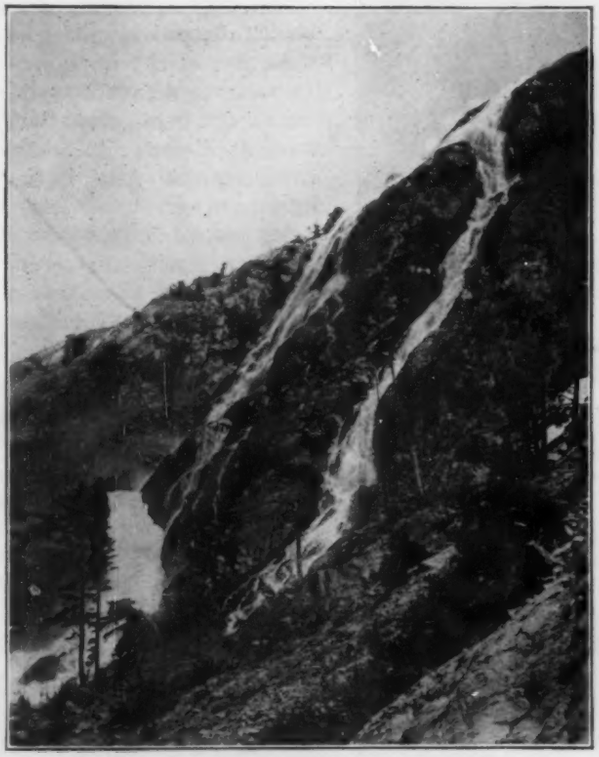
BY C. C. HOGAN.



The Agnew Lake Dam of The Rush Creek Development.

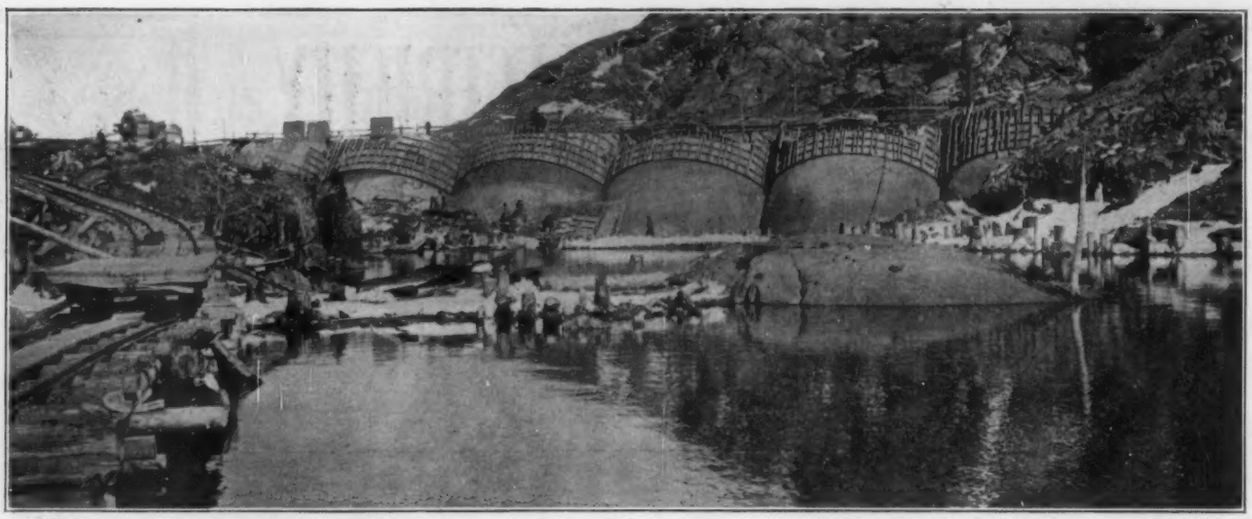
Power developments of the Pacific Power Corporation on Rush and Lee Vining creeks in Mono County, are being attacked ostensibly because of the injury such developments would inflict on some beautiful scenery connected with certain water falls high up in the Sierras on those creeks. These attacks are taking the form of newspaper and magazine articles glowing with righteous protestation against the destruction by the "Power trust" of Silver Lake and Lee Vining Falls, which, it is asserted, will deprive tourists of the enjoyment of "scenic beauties."

It is claimed by the officers of the power company that the real motive back of these attacks lies deeper than a patriotic desire to preserve the scenery,—that they are but a continuation of long drawn out controversy and litigation with certain interests headed by Wallis D. McPherson, who appears to be leading the "scenic beauty" propaganda. These interests, it would appear, sought to secure for themselves the identical water rights now being utilized by the Pacific Power Corporation, but being defeated in the courts and before the State Water Commission, it is alleged they now seek by an appeal to public sentiment to prevent others from using the waters in the same way they wanted to use it.



Rush Creek Falls.

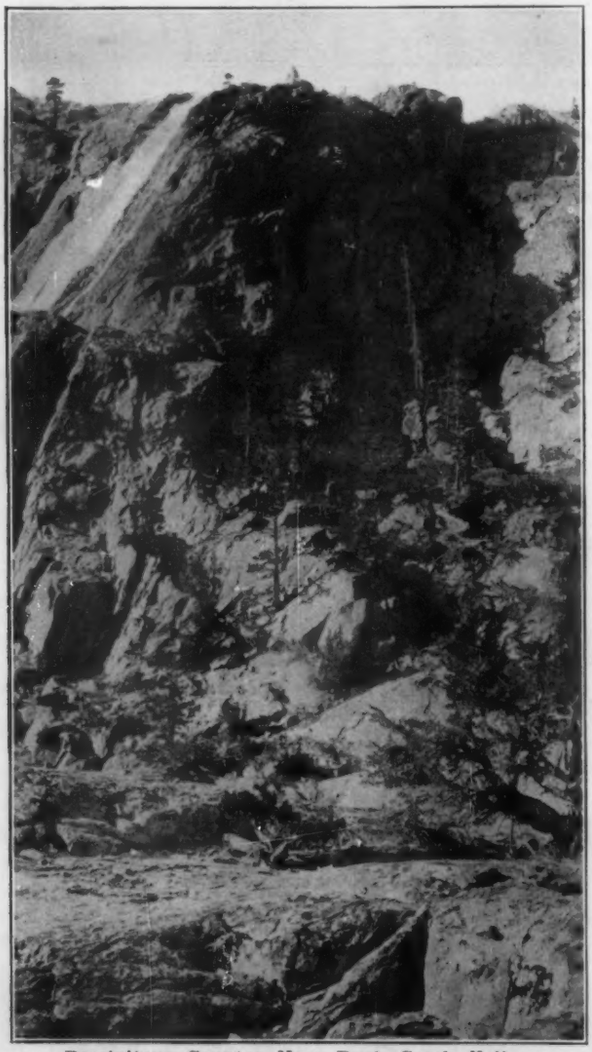
The history of the controversy and the lengthy litigation that has resulted, dates back several years, long before the wilds of Mono County were ever thought of as a beauty spot, and it is asserted by the power company that but for its pioneering in opening up the country and the construction by it at enormous expense of highways through the mountains, some of the falls in controversy would never have given their beauty to the aesthetic gaze of admiring tourists, but would have remained forever hidden away among the rugged fastnesses of the high Sierras and incidentally the electric energy which, when properly harnessed, they are



The Gem Lake Dam.

capable of generating, would likewise be forever denied for the use of mankind.

The power developments of the Pacific Power Corporation are being made by virtue of certain agreements made with the owners of the waters of Rush and Lee Vining creeks, and permits granted by the State Water Commission.



Precipitous Country Near Rush Creek Falls.

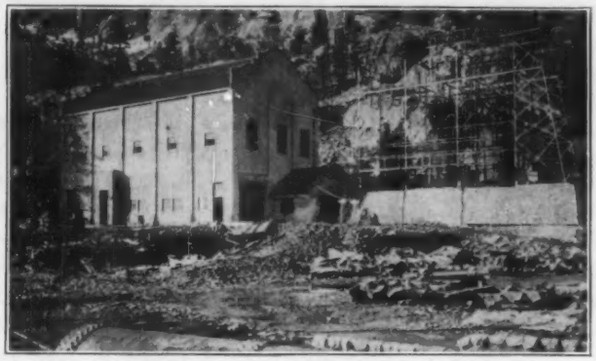
For years the inhabitants of the arid region in Mono Basin below Silver Lake and Lee Vining Falls have used the natural flow of those streams for the necessary irrigation of their lands. Conditions there were similar to other sections of the state in that without proper impounding of the waters and regulation of the stream flow, the irrigators were unable to get the full benefit of the water when most needed.

In 1902 a project was started by the incorporators of the California-Nevada Canal, Water & Power Company whereby the waters of Rush Creek were to be dammed at Agnew and Gem lakes, the waters conveyed therefrom through flumes and ditches upon the lands below for the benefit of the land owners. Application was shortly thereafter made by the canal company to the Interior Department for an easement over the government land at the damsites. The whole project was, after due investigation, given the sanction and approval of the Secretary of the Interior, with the proviso that the canal company would permit the use of the impounded waters for power, should a power applicant appear,—the contention of the government being that the location favored the development of power in addition to the irrigation benefits Subsequently, the Pacific Power Corporation, entered into an agreement with the canal company by which the power company was given the power right in accordance with the terms of the government's stipulation.

When the canal company first started surveys for its ditches, McPherson was employed as rodman with the surveying party. Foreseeing the possibilities of the project, and, so it is claimed by his erstwhile employers, desiring to tie up the waters for himself, while still in their employ, he posted a notice of appropriation and thereafter other notices on Rush Creek for a total of 101,500 inches. The first appropriation was made in 1910, notwithstanding the fact, it is asserted, that there were no surplus waters subject to appropriation at those times.

Subsequently he was instrumental in organizing the Mono Valley Improvement Company and the Rush Creek Mutual Ditch Company. The improvement company started an active advertising campaign to

induce settlers to locate upon desert land adjacent to the proposed ditches of the ditch company, under conditions that would compel them to purchase water stock in the ditch company. The company claimed



The Rush Creek Power House.

in its circular to control 30,000 inches of water on Rush Creek. By this means, it is asserted McPherson hoped to realize upon the questionable water locations made by him. The advertising campaign brought in a number of entrymen and it is asserted that as high as $40 per share was paid by some of them for stock in the ditch company. In order to show some semblance of good faith the ditch company commenced the construction of ditches with machinery, it is asserted, that was never paid for. In 1914, an attempt was made by McPherson's companies to make a connection with Rush Creek by constructing a ditch upon lands which they did not own, and for which no right of way had been secured. Suit was brought to enjoin this trespass and an injunction was granted. The ranchers, land owners and bona fide appropriators were then roused to action against what appeared to them as an attempted encroachment on their long established rights by McPherson and suit was instituted in the Superior Court of Mono County to secure an adjudication of the respective water rights, Judge Hancock of Calaveras County was appointed by Governor Johnson to try the case.

A decision just rendered excluded the supposed rights of McPherson and his companies, the Court finding, in effect, that the prior rights of the original bona fide appropriators and land owners take the entire flow of the stream; and therefore in 1910 at the time McPherson made his filings, there were no waters of Rush Creek subject to appropriation.

The Pacific Power Corporation is a great power system and with its connecting transmission lines, serves a large and rapidly growing section of the state, and also the mining districts of Nevada. The territory served extends from Mono County southward, a distance of over five hundred miles to the Imperial Valley and eastward into Nevada, a distance of one hundred and fifty miles to the Goldfield-Tonopah, Aurora, Wonder and Fairview districts.

The organization has invested millions of dollars in improvements and has been instrumental in developing large tracts of arid lands, mines and industries. Millions of dollars has been added to the state's taxable wealth, and our citizens have received the benefit of much needed service rendered.

It is claimed by the companies' officers that the developments in Mono County are made imperative by the rapidly increasing demands for power in the territory served.

TO SELECT MEN FOR STUDY OF FOREIGN MARKETS.

Markets for American goods in many countries are to be studied by men to be selected as a result of an examination which is to be given in the principal cities of the country by the United States Civil Service Commission on December 6th. The persons chosen are to act as trade commissioners and special agents for the Bureau of Foreign and Domestic Commerce. Their work is considered an important step in preparing the country to retain and expand its newly won foreign markets.

Ten appointments are to be made for the following investigations: Motor vehicles in Russia and the Far East; investment opportunities in Russia; fancy groceries in South America; furniture in South America; metal-working machinery and prime movers in Russia; metal-working machinery and prime movers in Brazil; jewelry and silverware in South America; hardware in Africa, the Near East, and India; ports and transportation facilities in Russia and the Far East, and mineral resources in the Far East.

The duties of appointees to these positions will be to obtain information concerning the demand in foreign markets for the particular commercial lines they are to study and to present the data obtained in straightforward, readable reports, which will enable American manufacturers and exporters to plan campaigns for the sale of goods in the markets investigated. Applicants for the South American investigations will be expected to know Spanish, and extra credit will be given for Portuguese. For work in Brazil, Portuguese is considered especially desirable. In the investigations including Russia, French is required, and an extra credit is given for Russian. No foreign language is required for the hardware investigation in Africa, the Near East, and India, or for the investigation of mineral resources in the Far East. No person will be admitted to any of these examinations who has not had previous training which would qualify him as an expert in the particular line to be investigated. This means substantial and responsible experience. An oral test will be given at Washington or some other city before final appointments are made, and only those who pass successfully the written examination on December 6th will be asked to present themselves.

The bureau will pay each of these men a salary not to exceed $10 a day, with all transportation expenses paid and $4 a day extra for subsistence. Persons who meet the requirements and desire this examination should at once apply for Form 375, stating the title of the examination for which the form is desired, to the United States Civil Service Commission, Washington, D. C.; the secretary of the United States Civil Service Board, post office, Boston, Mass., Philadelphia, Pa., Atlanta, Ga., Cincinnati, Ohio, Chicago, Ill., St. Paul, Minn., Seattle, Wash., San Francisco, Cal.; customhouse, New York, N. Y., New Orleans, La., or old customhouse, St. Louis, Mo. Applications should be properly executed and filed with the commission at Washington in time to arrange for the examination.

ANALYSIS OF VARIOUS TYPES OF IRRIGATION PUMPS.

BY R. H. CATES.

Vertical Centrifugal Pumps.

The largest number of tests were made on the vertical centrifugal type of plant and the means for this type are the most dependable. Curves showing the efficiencies for different sizes are plotted in Fig. 1. The numbers are the number of tests forming the mean result for each point. The points for the different sizes do not fall on a smooth curve. This is to be expected as other factors besides size affect the efficiency. The curves do show, however, the general increase in efficiency with the size. This is in accord-

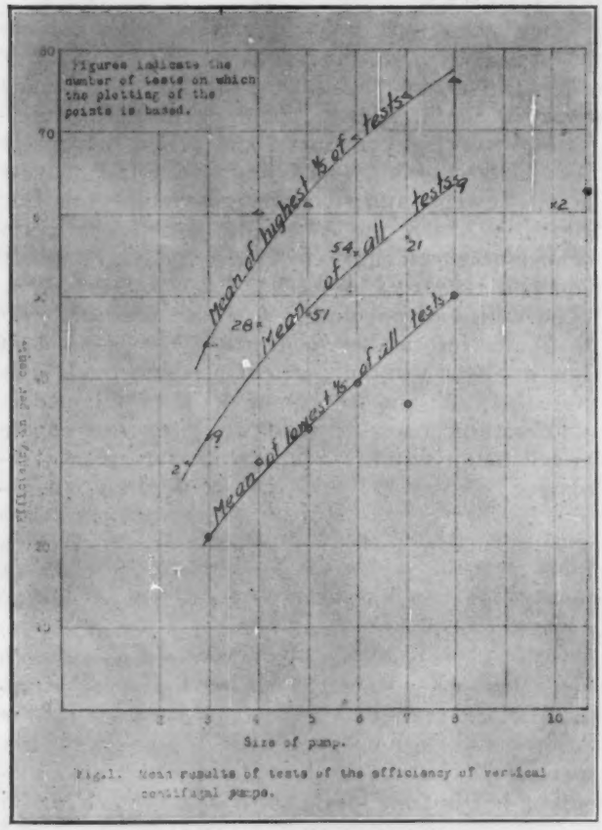

Figures indicate the number of tests on which the plotting of the points is based.
Mean of highest % of tests
Mean of all tests
Mean of lowest % of all tests
Size of pump.

Fig. 1. Mean results of tests of the efficiency of vertical centrifugal pumps.

ance with recognized usual practice. It is due to the smaller proportion of the mechanical losses in the larger sizes. It is also probably partially due to the greater care used in the construction and operation of the larger and more expensive plants.

Owing to the larger number of tests on vertical centrifugal pumps, an effort has been made to segregate the effects of various factors. This has only been done for the 4, 5, 6 and 7 inch sizes. The number of tests on other sizes were not sufficient for such classification.

Such a segregation was made on the basis of the height of lift for single stage pumps. The results are given in Table 3. The four segregations of lift were made for each of the four sizes of pumps. The result-the means were compared with the mean for the size of pump and the excess or deficiency computed. Table 3 gives the resulting excess or deficiency for all sizes combined. A somewhat lower efficiency at the lower lifts is indicated. For the smaller sizes multiple stage pumps are more usual for lifts of over 100 ft.

Table 3.

Variation of Efficiency of Single Stage 4, 5, 6 and 7-inch Centrifugal Pumps With the Lift.

Height of Lift.	Number of Tests.	Average Variation of Efficiency from Mean Efficiency.
Less than 50 feet.....	31	—4.9
50 to 75 feet.....	49	—0.3
75 to 100 feet.....	24	+4.7
Over 100 feet.....	24	+4.7

A classification was also made to see if the efficiencies for the different sizes varied with the amount of the vacuum or with the quantity discharged. The results were not conclusive. For vacuums of over 25 inches of mercury or 28 ft. of water, the average efficiencies were somewhat below the normal. Nearly one-half the plants operated at a vacuum of over 20 ft. With high vacuums efficient results can be obtained if there are no air leaks. Such vacuums, however, always involve the possibility of a material loss in efficiency if any leaks should occur.

The results of the classification of efficiencies on the basis of the discharge were also irregular and not conclusive except where the quantity pumped was materially less than the average.

Twenty-four tests of 2-stage pumps are available. These are used in some cases for lifts of from 75 to 100 ft. but more largely for lifts of over 100 ft. The results are given in Table 4.

Table 4.

Results of Tests of Two Stage Vertical Centrifugal Pumps.

Size of Pump.	Number of Tests.	Mean Discharge Miners' Inches.	Mean Lift. Feet.	Mean Pump Efficiency.
3	4	16	106	34.0
4	7	44	109	41.0
5	10	63	111	44.6
6	2	117	104	68.0
7	1	100	120	47.6

The results of a number of individual tests of vertical centrifugal pumps are given in Table 2. These cases were selected to bring out the extent to which various unfavorable factors may affect the efficiency. Such factors are usually faults in operation and not the fault of the pump itself. Operation at capacities, lifts or speeds different from those for which the pump was designed, air leaks in the suction, and worn or clogged runners, are some of the conditions found to reduce the efficiency by from one-third to one-half in some cases.

Horizontal Centrifugal Pumps.

The thirty tests on these types of installations include the sizes in general use, but those for any one size are not sufficient in number to give as dependable means as for the vertical centrifugal pumps. Comparing the results with similar sizes of vertical centrifugal pumps, the horizontal pumps have an average pump efficiency slightly higher than the vertical pumps. The average overall efficiencies are also somewhat higher due to the greater proportion of the horizontal pumps which are direct connected. These differences may, however, be within the probable error of the mean for the thirty tests available.

Horizontal centrifugal pumps are not generally used for pumping from wells in this territory, due to the larger pit which would be required, and the wide variation in pumping levels throughout the season.

Those tested are used mainly for lifting from canals or from reservoirs after the water has been

pumped from wells, or what is known as booster service.

The tests indicate an increase of efficiency with an increase of size, although the individual sizes vary.

Well Turbine Pumps.

The results of fifty-five tests of well turbine pumps are given. These are classified by sizes, the sizes given representing the size of the well casing in which the pump can be installed.

These pumps have multiple stages, the number of stages varying from 2 to 12, depending upon the lift and the discharge. The lift per stage varies from 12 to 40 ft.

The efficiencies increase in a general way with the size, although not as regularly as for the centrifugal pumps. This irregularity is probably due to the smaller number of tests for some of the sizes.

Comparison between well turbine and centrifugal pumps can best be made on the basis of equal discharge as the basis of the rating for size is different. The 12-inch turbines having an average discharge for 25 tests of 63 inches, gave a mean pump efficiency of 49.7 per cent. Fifty-one number 5 vertical centrifugal plants which had a mean discharge of 64 inches gave a mean efficiency of 47.8 per cent. Nine 24-inch turbines discharged an average of 115 inches with a mean pump efficiency of 55.6 per cent. Interpolating between the mean discharges and efficiency of the number 6 and 7 vertical centrifugal pump, the efficiency for a discharge of 115 inches would be about 55.4 per cent. A similar interpolation for a discharge of 84 inches gives a mean efficiency of 50.1 per cent for 8 turbine tests and 52.2 per cent for the vertical centrifugal pumps. These figures for the efficiency of the two types of plants are so nearly in agreement that there appears to be no material advantage in efficiency for either type.

The results of certain individual tests of well turbines the given in Table 2. These show the effect of various factors on the efficiency as explained in the remarks.

Propeller Pumps.

The basis of classification of propeller pumps is not as uniform as with other types. The twenty-one tests available are averaged without segregation in Table 1. The larger number of these were equivalent to an 8-inch size. The lift per stage is smaller with the propeller type of pump than with well turbines, being generally about five feet.

Further detail regarding the tests of this type of pump is given in Table 5.

Table 5.

Results of Tests of the Efficiency of Propeller Pumps.

Mean Discharge in Miners' Inches.	Number of Tests.	Pump Efficiency.	Mean Lift.	Number of Tests.	Pump. Efficiency.
27	2	27.2	32	6	42.2
68	5	38.8	54	4	41.0
104	8	50.0	68	6	42.9
140	4	42.2	94	5	47.0
325	2	46.3	..	..	....

These figures are lower than those for vertical centrifugal and well turbine pumps of similar capacity, the difference in efficiency varying from 5 to 15 per cent. The number of tests of the propeller pump is relatively small and the results may not be altogether representative.

Piston Pumps.

The piston types of pump in use in irrigation can be divided into three classes, the deep well plunger pumps and the duplex and triplex pumps. The deep well plunger pumps are usually double acting, but due to the placing of the cylinders at the bottom of relatively deep wells with the long rods necessary for their operation and the greater difficulty in attention, the efficiencies are lower than for the duplex and triplex pumps. These latter two types are more generally used for booster service such as pumping from a reservoir to higher levels rather than for pumping from wells.

The tests of the piston pumps gave the highest efficiency of any of the types of pumps shown in Table 1. The deep well plunger pumps are considerably higher than centrifugal pumps of the same capacity. The same is true for the duplex and triplex pumps. Piston pumps are used on relatively high lifts so that such higher efficiencies result in relatively larger saving of power.

In Table 2, the results of some individual tests are given. Higher efficiencies were secured in two of these cases from higher lifts. The effect of gas in the water in reducing the efficiency is quite marked in the last case given. A similar loss of efficiency would occur with other types of pumps.

Air Lifts.

Only seven tests of air lift plants are available. The average efficiency was lower than that for the other types of pumps. The minimum result was obtained for a plant pumping less than 3 miners' inches, which is much smaller than usual irrigation practice. While the number of tests is small, the mean probably is fairly representative of average good practice with this form of lift.

In table 2 the results at a plant where an air lift was replaced with a well turbine are given. The turbine developed more water from the well and also at a higher efficiency.

Summary.

The general results are given in Table 1. A discussion of the efficiency of each type of pump with some comparisons with other types has also been given. Where the results with different plants of different sizes and types vary so widely, average results of all types or sizes furnish little indication of what can be expected in any particular case.

As a measure of the average conditions in the territory covered by the Southern California Edison Company, the average results of these 305 tests may be of value. The conditions vary within the different parts of the area, the lifts and the quantity of water secured from wells differing widely.

For the 305 tests, the average lift was 92 ft., and the average discharge 92 miners' inches. For all types of pumps the average efficiency of the pump was 51 per cent, and the overall efficiency for the plants 42.4 per cent. The ratio of overall to pump efficiency was 83.0. For these conditions an average of 2.51 miners' inches were pumped 100 ft. per kilowatt of input. This is equivalent to 2.42 kilowatt hours per acre foot lifted one foot. It will be remembered of course, that it is not advisable to base estimates for individual installations upon average figures

THE INSTALLATION OF ELECTRIC HEATING APPARATUS.

BY. E. A. WILCOX.

Correct Installation.—This is essential for ranges, water heaters, and other heating devices. If wires are too small, the service will be poor. If the appearance of the work is not good, the user will be dissatisfied. If proper protection against electric shocks is not afforded, the customer may be in constant fear. If a range, for instance, is not placed in such a position that it can be conveniently operated by the cook or housewife, she may form mental prejudices that will be difficult to overcome. Intelligent supervision and caretul inspection of all heating installations will be of mutual benefit to all concerned.

Wiring for Heating Apparatus.—The Code of the National Board of Fire Underwriters should be adhered to as closely as possible in wiring for heating apparatus. Furthermore, local city and state rulings have a distinct legal status the importance of which should not be overlooked. Unfortunately the National Code rulings which apply to the installation of heating service are in some cases burdensome, and in others not strict enough.

All wiring should be done in a neat and workmanlike manner so that an electric installation will not detract in any way from the appearance of the premises. Electric ranges, water heaters, and other heating devices on the market usually look attractive, but if they are not properly connected and installed the general appearance may be bad.

Carrying Capacities of Wires.—The allowable carrying capacity of conductors operating under pressures of 120 volts, two-wire, and 120-240 volts, three-wire, are given in Table I for convenient reference

Table I.

Maximum Allowable Wattage Carrying Capacity.

Size	Area	—Rubber Covered—		—Weather Proof—	
B. & S. Gauge.	Circ. Mils.	120 volt. 2-wire.	120-240 v. 3-wire.	120 volt 2-wire.	120-240 v. 3-wire.
0000	211,600	27,000	54,000	39,000	78,000
000	167,800	21,000	42,000	33,000	66,000
00	133,100	18,000	36,000	27,000	54,000
0	105,500	15,000	30,000	24,000	48,000
1	83,690	12,000	24,000	18,000	36,000
2	66,370	10,800	21,600	15,000	30,000
4	41,740	8,400	16,800	10,800	21,600
6	26,250	6,000	12,000	8,400	16,800
8	16,500	4,200	8,400	6,000	12,000
10	10,380	3,000	6,000	3,600	7,200
12	6,530	2,400	4,800	3,000	6,000

Wires of sufficient size to conform to the allowable carrying capacities in the above table will conform to the Underwriters' Code but may prove too small to insure good service. This will be true if the run is a long one because in the above table no account is taken of its length.

Table II shows the drop in voltage (below 120) that may be figured per hundred feet of both two and three-wire circuits. The calculations are based on an assumed pressure of 120 volts for two-wire service and 120-240 volts impressed on a three-wire circuit.

Table II.

Wattage Load on End of Line.

No.	2500		5000		7500	
B. & S. Gauge	2-wire.	3-wire.	2-wire.	3-wire.	2-wire.	3-wire.
0000	.204	.102	.409	.204	.619	.306
000	.258	.129	.515	.258	.774	.386
00	.325	.162	.650	.325	.975	.487
0	.410	.205	.819	.410	1.229	.615
1	.517	.258	1.033	.417	1.550	.775
2	.651	.326	1.303	.651	1.954	.977
4	1.036	.518	2.071	1.036	3.107	1.553
6	1.647	.824	3.294	1.647	4.941	2.471
8	2.618	1.309	5.237	2.618	7.855	3.927
10	4.164	2.082	8.329	4.164	....	6.246
12	6.623	3.312	....	6.623	....	9.935

No.	10,000		15,000		25,000	
B. & S. Gauge	2-wire.	3-wire.	2-wire.	3-wire.	2-wire.	3-wire.
0000	.818	.409	1.238	.619	2.044	1.022
000	1.030	.515	1.548	.774	2.576	1.288
00	1.200	.650	1.950	.975	3.250	1.625
0	1.638	.819	2.458	1.229	4.096	2.048
1	2.066	1.033	3.100	1.550	5.166	2.582
2	2.606	1.303	3.908	1.954	6.515	3.257
4	4.143	2.071	6.214	3.107	....	5.178
6	6.588	3.294	9.882	4.941	....	8.235
8	....	5.237	....	7.855	....	....
10	....	8.329	....	....	....	....
12	....	....	....	....	....	....

Correct Voltage.—For heating apparatus this is important. Many complaints may be obviated by supplying energy at a pressure as near as possible to the rated voltage of the apparatus. Low voltage results in slowness of operation, and excessively high voltage is likely to cause burn outs.

Assume a heating element rated at 1100 watts and 110 volts is supplied with energy at a pressure of 100 volts. The resistance of the element is therefore: $R = E/I = 110/10 = 11$ ohms.

At 100 volts pressure the quantity of current flowing would be $I = E/R = 110/11 = 9.1$ amperes and the wattage dissipated in heat would be $W = EI = 9.1 \times 100 = 910$ watts. The efficiency of operation of the element, therefore, would be $910/1100 = 82.7$ per cent, whereas the voltage was supplied at only $100/110 = 91$ per cent of the normal rating.

Voltage readings should always be made at the terminals of the heating device at no load and at full load, otherwise the drop in voltage in the service leads or interior wiring may be overlooked, and a wrong impression gained.

Methods of Wiring.—How to wire a building for heating service should be carefully considered before the actual work is undertaken. Exposed wiring with knobs and cleats is safe and cheap but is seldom used because of its unsightliness. Moulding work is sometimes installed in old buildings but unless the work is done extremely well it may look unattractive. The concealed knob and tube method is often used in both new and old buildings and the work may usually be done at reasonable cost. Rigid or flexible conduit, or steel armored conductor wiring are generally considered to be the best, although the most expensive methods.

Exposed Knob and Cleat Wiring.—This is often used in wiring for heating and cooking service and in places where appearance is of little consequence it is one of the cheapest and best. The wires may be single braid rubber-covered or slow burning weather-proof. In cellars or other places exposed to moisture rubber-covered wire must be used.

Wooden Moulding Wiring.—Where a neat appearing low-priced job is required this construction may well be used. Its use in damp places is however prohibited by the Underwriters. Single braid rubber-covered wire is required. For first class work hard wood moulding, matching in finish the trim of the room, can be used.

Wiring in Metal Moulding.—As this is restricted to circuits carrying not more than 1320 watts it is seldom employed for heating or cooking circuits. Single braid rubber-covered wire may be used for this class of work. Metal moulding must always be grounded permanently.

Concealed Knob and Tube Wiring.—In frame buildings where a low cost of installation is essential the wires may be installed within floors and partitions. Wires can ordinarily be concealed in this manner more cheaply than by any other method. Single braid rubber-covered wire may be used.

Rigid Iron Conduit.—This is approved for both exposed and concealed work. Ordinarily it is probably the best, although the most expensive. Double braid, rubber-covered wire must be used in rigid conduit. The same conduit may contain as many as 4 two-wire or 3 three-wire circuits. Stranded wire in sizes larger than No. 6 is customarily used for rigid conduit work. Rigid conduit must be permanently grounded.

Table III.

Size of Wire, B. & S. Gauge.	Size of Conduit, Inches. Two Wires in Conduit. Short Run.	Medium Run.	Long Run.	Three Wires in Conduit. Short Run.	Medium Run.	Long Run.
10	½	¾	¾	¾	1	1
8	¾	¾	1	1	1¼	1¼
6	1	1	1¼	1	1¼	1¼
4	1	1¼	1¼	1¼	1¼	1½
2	1¼	1½	1½	1¼	1½	2
1	1¼	1½	2	1½	2	2
0	1½	2	2	2	2	2
00	1½	2	2	2	2	2½
000	2	2	2	2	2½	2½
0000	2	2	2½	2	2½	3

Table III shows the size of double braid rubber-covered wires that can readily be pulled into conduit.

Flexible Metallic Conduit.—For all kinds of exposed or concealed work such construction is often preferable to rigid conduit. The installation of flexible conduit can be made easier, quicker, and more cheaply than can riged conduit. The same code rules apply to flexible as to rigid conduit. It must be securely grounded. Double braid rubber covered wire is required. Flexible metallic conduit may be used to advantage in finished houses and in frame buildings.

The sizes of wire that may be accommodated in flexible steel conduits are given in table IV.

Table IV.

Nominal Inside Diam. In Inches.	Largest Wires Accommodated. One Wire.	Two Wires.	Three Wires.
½	8	12	..
¾	2	10	12
1	00	0	8
1¼	200,000	4	6
1½	400,000	1	3
2	800,000	200,000	00

Flexible Steel Armored Conductor.—Here a cable consisting of rubber-covered wires is protected from injury and to a certain extent from dampness by two layers of flexible steel armor. It may be obtained leaded or unleaded. The leaded cable differs from the unleaded in that it has a lead covering between the wire and the steel armor to protect it from excessive dampness. Both the leaded and the unleaded cables are made with single and multiple conductors of almost any gauge wire. The leaded cable is approved for all classes of work, open or concealed, in fireproof or non-fireproof buildings, and in new or old houses. The unleaded cable is approved and may be used for open or concealed work in places not subject to moisture.

For wiring old buildings steel armored conductor can be used to great advantage. It can be run with utter disregard to contact with pipes or other materials and may be fished for long distances. It can be installed quicker and with less cutting away of the walls and floors than either rigid conduit, flexible tubing, or concealed knob and tube work. Steel armored conductor should always be carefully grounded.

The Main Entrance Switch.—For three-wire heating circuits this should always be of the fused type with the neutral fuse coppered.

Control Switch.—Heating devices should be provided with control switches that will indicate at a glance whether the circuit is open or closed. The switch should be mounted on the device or on the wall immediately adjacent to it so as to be easily accessible. It should be of the enclosed knife blade or snap switch type and so designed as to entirely disconnect the heat-type appliance at the wish of the operator.

Grounding.—The frames of all heating appliances, especially those of the larger types, should be carefully grounded, whether they are connected to two-wire or three-wire circuits. Satisfactory grounding may be accomplished by connecting the frame of the device to a water pipe. If the appliance is operated from a three-wire grounded neutral system the frame may be connected to the neutral wire. In case of doubt as to the character of the ground on such a system, the neutral may be grounded, in turn, to some convenient water pipe inside the building.

When a rigid or flexible metallic conduit or steel armored conductor job is installed, the frame of the device may be grounded to the conduit or steel armor; provided, of course, the conduit or armor is itself grounded elsewhere.

Ranges in Apartment Houses and Flats.—In this case separate circuits from the main switchboard are necessary. Each circuit must be fused but in the case of three-wire circuits the neutral should be coppered.

Main service wires and switches supplying group cooking loads are never called upon to carry the entire connected load. Apartment houses equipped with ten or more ranges are never known to have a demand greater than one-fourth the connected load. The larger the number of ranges supplied from a single service the less will be the demand in proportion to the load connected. This is a condition seldom met with in supplying other classes of electric service and one for which no provision has been made in the Underwriters' Code. It is obvious, however, that to install service leads, main switches, fuses, etc., of sufficient carrying capacity to handle the total connected load would be of no advantage, and would involve needless expense.

The Proper Position for a Range.—The range should be located where it can be operated with ease and convenience. If it is placed where the light is bad, in an inaccessible corner of the kitchen, or where the cook or housewife has to walk back and forth a greater distance than that to which she has been accustomed, a serious prejudice may be created in her mind. An electric range is often installed in a kitchen by the side of a coal, gas, wood, or oil range, the latter being left in, either for auxiliary use or for want of a better place for storing the old equipment. When this condition is met, every endeavor should be made to secure permission to place the electric range in the most advantageous position. Otherwise the customer will have a tendency to use the appliance most favorably located for most of her work.

THE POLICY OF UTILITY.

In a discussion of efficiency methods in public utilities at the recent convention of the Pacific Coast Gas Association, Mr. E. L. Hall of the Portland Gas & Coke Company outlined some very useful pointers that must be borne in mind in order that efficiency may flourish in a public utility, an excerpt of which appears in the following lines:

The ideal aims of the utility, rightfully considered and firmly established, form, as it were, the soul of the utility, while efficiency methods are the brains and the organization the hands. Even as the man with a paltry soul, a narrow mind, and sordid instincts, may not succeed greatly, so will it hardly be feasible for a utility organized under similar lines to attain that ultimate standing in the community which will insure a sound business and reliable profits.

Efficiency methods and clock work organization may, therefore, only achieve permanent success when inspired by high motives and right principles, and those utilities throughout the land whose position is being daily strengthened, are those wherein such principles have been whole-heartedly observed and permeate their organization.

Failure or success of efficiency methods depends in a great measure upon the general policy of the company. It may be conceived that the aim of any utility is essentially to make reasonable earnings for the stockholders. Modern conceptions have insisted that such returns will derive their permanence and security chiefly through the good will of the community served and freedom from embarrassing legislation.

Such good will is secured principally by the quality of service rendered, by a public spirited attitude towards municipal progress, by a liberal and humanitarian treatment of employes, and above all, by a generally sympathetic and progressive attitude.

Freedom from oppressive and embarrassing legislation is a logical sequence of public good will.

As applied to the inner workings of the utility, the foregoing finds application principally in the inculcation of progressive ideas throughout the rank and file of the stockholders, officers, and employes, so that concerted efforts are made possible toward the realization of the aims and purposes of the utility. An understanding of the psychology governing the attitude of employes towards the utility, towards the public and towards one another is an essential for the establishment of the right esprit de corps. The creation of such a favorable atmosphere is thus the first requisite and step toward the inauguration of efficiency methods. The essential thought which must permeate the organization is that results cannot be accomplished by individual effort as cheaply and expeditiously as by concerted action. In a word, team work must replace the natural desire of the individual for direct action. At all cost, the ego must be suppressed. Pride in organization should replace pride in one's self.

At the same time, since the assertion of individuality is a means by which each employe earns his promotion and establishes himself, and since this individuality is, from an organization standpoint, to be subjected to team work, the reward attendant to the success of concerted efforts should flow with certainty to each and every individual employe responsible for such success. In other words, if the employe is to efface himself he must well understand that he will not lose thereby. A lack of appreciation of this psychology creates suspicion and antagonism towards the efforts of the leaders in efficiency work. Too often those intrusted with working up an efficiency organization are powerless to remove the muzzle from the ox when he treadeth out the corn.

Failure to establish a generally receptive attitude towards efficiency methods quite frequently results from neglect of the management to furnish the necessary incentive.

To recapitulate: The following policies are necessary for efficiency to flourish:

1. A liberal conception of the duties and aims of the utility.
2. A progressive environment and personnel.
3. Provision for sufficient incentive.

COST OF ELECTRIC COOKING.

A recent advertisement of the Minneapolis General Electric Company contains some statistics showing the actual cost of electricity in households of various sizes where cooking is done electrically. The figures are quoted:

Number in Family.	Average Monthly Bill.
Family of three	$2.62
Family of four	2.79
Family of five	2.82
Family of six	3.05
Family of seven	4.46
Family of eight	5.99

It will be remembered that the Minneapolis company in the spring of 1916 reduced its rates so that in the tertiary step all domestic customers secure electricity at a cost of 2½c (less 5 per cent prompt payment discount) per kilowatt hour. As a result of this rate the amount of electric cooking business secured in Minneapolis during the summer and fall has been gratifying.

INDUSTRIAL FATIGUE.

A scientific investigation upon industrial fatigue by a well known English authority as set forth in the Electrical Review published in that country, is timely and interesting:

The author draws from his observations a strong argument against the practice sometimes adopted of working on Sunday; whereas in normal times the lessened efficiency found towards the end of the week is remedied by the rest obtained on Saturday afternoon and Sunday, if Sunday labor is introduced the rest period is inadequate, and the fatigue becomes permanent and cumulative, so that eventually the worker either breaks down under the strain, or, consciously or otherwise, slackens his efforts until equilibrium between fatigue and recuperation is once more attained. In either case the result is disastrous from the point of view of output, and often from the point of view of health also.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

Twenty-two dollars a year is spent on an average by every person in the United States for electrical material and service. Four dollars of this goes to the central station.

* * *

The Court Square of Memphis, Tenn., rich in traditions of the days of Andrew Jackson, is to have its beautiful fountain elaborately lighted during America's Electrical Week.

* * *

Enough hydroelectric energy is running to waste to equal the daily labor of 1,800,000,000 men or 30 times our adult population, according to Secretary of Interior Franklin K. Lane.

* * *

A concerted movement on the part of manufacturers, engineers, and college authorities is now under way that bids well to bring research and business into closer contact in the future.

* * *

Seventy per cent of the people of this country use electricity in some form every day of their lives. Five per cent of the people—five million persons—derive their living directly or indirectly from the electrical industry.

* * *

The new year is soon to be here. Herbert Kaufman's advice is apropos of this season of resolutions: "You've tried one pass key to opportunity and it didn't fit—but what of that? Keep trying them, and unexpected doors may open to you."

* * *

One of the heaviest cables ever handled by a power, telephone or telegraph company was recently installed in Vineyard Sound in Massachusetts. It is a twelve conductor telephone cable and is 2.69 inches in diameter, weighing 10.6 pounds to the foot.

* * *

In comparison with over fifty million horsepower of locomotives, over forty million horsepower of automobiles and a total of over one hundred fifty million mechanical horsepower, government reports show that thirty million horses and mules are in service today in the United States.

* * *

An Eastern power company boasts one electric range per one thousand population. To beat Western enterprise the wise men of the East will have to do better than this, since a power company in Southern California has itself actually sold already over twelve hundred electric ranges.

* * *

A huge revolving ball of light crowning the topmost pinnacle of the highest building in Toledo, Ohio, rising five hundred feet from the street level, will soon be seen miles in every direction around this enterprising city. This ball of light will measure twelve feet in diameter and will be equivalent to about five thousand ordinary electric sign lamps.

Here are six reasons for wiring old houses, according to the Louisville Gas & Electric Company: (1) Money invested in house wiring pays 25 per cent; (2) Wired houses sell for more; homeseekers want modern conveniences; (3) Electric wiring is "tenant insurance"; (4) Electric service is economical; (5) Electric light is convenient; (6) Electric light lessens fire hazard.

* * *

In the presence of President Wilson and a distinguished gathering of foreign ambassadors and representatives America's Electrical Week will be fittingly ushered in on December 2d by the inauguration of the permanent flood lighting of the Statue of Liberty. More reflectors will be required to accomplish this feat than have been required to flood-light any building or palace to date.

* * *

Ohio has gone a step farther than bringing municipal plants under the same regulation as private plants and requires that municipal plants either must sink or swim on their own resources and cannot draw on the general tax fund to pay deficits. This is good business and for the protection of the public. There seems to be no valid reason why these plants should not come under the public service commission rulings.

* * *

The continued increase in the market price of coal and crude petroleum is beginning to affect earnings of central stations the country over. The New York Edison Company stipulates that it may have to reconsider its acceptance of a reduced rate arrangement because of the grave uncertainties with which the future of operating costs is clouded, and in so doing it calls attention in a necessary way to an uncontrollable element which the future holds.

* * *

Railroad electrification seems to have brought out unthought of advantages over steam propulsion. Last winter, for instance, the Mogul engines on the St. Paul, with the temperature at 40 below zero, froze to the tracks, with more than half a mile of cars behind them. The electric motor, with only two engineers aboard, as against six to pull and push each of the freight trains, pulled the locomotives and trains to their proper destination, working even better in cold weather than such motors do when the weather is warmer.

* * *

The electrical man, if there be one, who does not believe in co-operation may well ruminate over the words of Emerson: "There is a time in every man's education when he arrives at the conviction that envy is ignorance, that imitation is suicide; that he must take himself for better or for worse as his portion; that though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given him to till.

JOURNAL OF ELECTRICITY
POWER AND GAS

FOUNDED 1887

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each,	.25

NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

CONTENTS

The Rush Creek Controversy 407
By C. C. Hogan.

To Select Men for Study of Foreign Markets 409

Analysis of Various Types of Irrigation Pumps 410
By R. H. Cates.

The Installation of Electric Heating Apparatus 412
By E. A. Wilcox.

The Policy of Utility 414

Cost of Electric Cooking 414

Industrial Fatigue 414

Sparks—Current Facts, Figures and Fancy 415

Editorials 416
- Necessity of Experience in Business Getting.
- Power Development vs. Natural Beauty.
- The Scarcity of Oil Scare.

Personals 418

Meeting Notices 418
- Los Angeles Jovian League.
- Portland Meeting A. I. E. E.
- San Francisco Section A. I. E. E.
- Electrical Development and Jovian League, Pacific Coast N. E. L. A. Section.

Notes of California Water Commission 419

New Bulletins 419

Trade Notes 419

News Notes 420

Necessity of Experience in Business Getting

Experience in business-getting is each day proving itself to be of vital necessity to the engineer. Some years back, when gigantic progress was being made in the evolution of electrical engineering, fame and fortune were often amassed by a man who had ability in pure and applied engineering science alone without particular training in the art of business-getting.

In those days the idea of electrical novelty and the vastness of an unexplored field made possible such a state of affairs. Today, however, conditions have changed. Much of the former unexplored realm of electrical application has now been traversed, mapped and put to commercial use.

In view of this fact there is a tendency for the modern, young engineer to be swamped or muddled in the application of this complex accumulated data. Actual experience in business-getting is the only way in which one may learn to unravel the tangled mass and put it to a useful purpose.

As stated in a recent address by a noted business expert in electrical affairs, the man in the selling game has to think, think straight and think quickly. There is no better experience than to have a try at the actual selling of goods. If the engineer has at one period in his career made a marked success as a salesman, there is hardly a job that he can tackle in after years which he can not finish successfully due to this valuable experience gained in the field of salesmanship.

Again, looking at the proposition from the other viewpoint, the art of business-getting is vastly advanced by having in its ranks men of the trained analytical mind. The great electrical industrial companies have in recent months come to this forceful conclusion. So much so, that the applications of cadet engineers or apprentices are largely today approved on the basis of the future business-getting possibilities that the young embryo engineer seems to possess.

Engineering as a profession is rapidly broadening in its scope of usefulness. The business-getting, managerial and executive departments of large corporations are looking to the ranks of the young engineers for their future heads and directors.

A thorough business training and experience is hence to be sought by the engineer, and with this brought to realization, success is sure to await the future.

Power Development vs. Natural Beauty

During recent years—especially since the beginning of the present international war—the campaign for "See America First" has received the commendation and moral support of all well-wishers of the West. It is true beyond the question of a doubt that sentiment is not alone the leading factor that urge men to ask their fellow citizens to become more intimately acquainted with the natural beauty of their own country before spending time and money abroad. Beneath it all there is a deep conviction on the part of those who have seen the really great

and sublime works of nature in this country and compared them with the choicest collection of natural wonders to be found elsewhere in the world that here God seems to have blest man with natural beauty wonders to a greater degree than to be found elsewhere. A glimpse of Niagara, the Yellowstone, the Yosemite, the Hetch Hetchy, the Grand Canyon, the Glacier National Park and a hundred other of our fairy wonders is abundantly convincing to every doubting Thomas.

Hence it is not surprising that a storm of protest is heard on all sides when it is thought that some natural beauty is be destroyed by the hand of man in search of water power development. And it is perfectly right and proper that this storm of protest should be so all-sweeping as to prevent the proposed work in instances where undue trespass is being made upon our storehouse of natural beauty.

Upon careful investigation, however, practically all of the protests against proposed water conservation or power development on the grounds of wanton destruction that have been registered in recent years have proved unwarranted after all the facts have become known.

A special instance of this has proven true in the case of the Hetch Hetchy. Here is an instance wherein more publicity was given in magazines of national repute than in any other case. And yet today the visitor to this beautiful valley must admit that the accessibility brought about by the splendid road that has been built there by the authorities of the city of San Francisco has far repaid the imagined sacrifice of natural beauty. Indeed, it must be admitted that the completion of this highway around the proposed lake and the increased beauty resulting from the creation of this lake will make the wonderful waterfalls and massive vertical cliffs of this impressive gorge even more imposing.

On another page of this issue is to be found a discussion of the Rush Creek controversy that involves certain development work of the Pacific Power Corporation. The perusal of its contents will give the readers of the Journal a fairly good idea of the many points or arguments that are thrown in the way of the power company desirous of developing the natural resources of a sparsely settled country.

The "scenic protest" is like the New York "Mother hubbard" that is said to cover everything and touch nothing. True lovers of the scenic beauty of the West should see to it that natural beauty is not wantonly destroyed and yet at the same time that equi-balanced justice is given to the company earnestly engaged in promoting the welfare of a new country by developing its natural resources to their highest stage of productivity.

The Scarcity of Oil Scare

It is true that hydroelectric development in the West is at present receiving an impetous due to the high market price of fuel oil. It is likewise true that the Director of the U. S. Bureau of Mines in a recent address predicted the exhaustion of the crude petroleum supply some thirty years hence at the present rate of consumption.

The most casual investigation, however, will show that the present high price of crude oil is not due to any apparent diminution in the production of this product, for during September of the current year two hundred and sixty thousand barrels were produced as opposed to the two hundred and fifty thousand of January, 1915.

Again, accordi::g to Secretary Lane in Senate Document 310, it is shown that the percentage of exhaustion in all oil wells is but twenty-six and the estimate of oil still in the ground of the known fields in California is 2345 million barrels. At the present rate of production this should last for three hundred years.

As to the argument that the oil supply should be set aside for the enlarged navy, it may be mentioned that Secretary Daniels estimates the oil consumption for this purpose, when counting the addition of nine battleships and seventeen destroyers will be seventeen hundred sixty barrels, which in times of war may be placed at five million barrels annually.

The government already has undisputed title to Naval Reserve No. 1 in California, which at this same hearing was shown by officials of the United States Geological Survey to hold in reserve one hundred million barrels, a supply adequate for fifty years for the national navy.

By examining the factors that enter into fuel oil consumption, it will also be seen that a decreased use may be expected from many quarters. The success of the electrification of the Rocky Mountain Division of the Chicago, Milwaukee & Puget Sound, followed by the recent announcement of the early electrification of the Great Northern Railroad but presages the similar electrification of all Western trunk lines in the immediate future. Such procedure will vastly lessen the demand for fuel oil.

On the other hand the continued announcement of oil discoveries in various sections of the United States and more recently of Alaska give promise of an ever widening field of development of this product rather than a diminution in supply.

The time was not far back when steam auxiliary plants of the West were built oil fired, but with spacious apartments left for coal bunkers in case of the necessity of a change over from fuel oil to coal operation. No such uncertainty today exists.

The present abnormal market value of this product is, however, making many central station managers seriously ponder the possibility of hydroelectric development which again will lessen the consumption of oil.

As soon as the unusual conditions brought on by the present international war readjust themselves the gigantic demand now being made upon the oil fields will again be lessened and the market value of this product will undoubtedly drop to a more reasonable figure.

Hence, from every reasonable point of view it is to be seen that the present "scarcity of oil scare" is but a temporary aberration and those having to do with either the production or the consumption of this valuable product may look forward to an early balance in demand and continued supply.

PERSONALS

O. B. Stubbs, owner of the Stubbs Electric Company of Portland, is at San Francisco.

H. A. Joslin has been appointed local manager of the Oregon Power Company at Eugene, Ore.

Charles French, electrical contractor of Vallejo, spent a few days in San Francisco last week on business.

L. F. Youdall, manager of the Electric Machinery & Equipment Company of Stockton, was a recent business visitor at San Francisco.

Frank Cook, sales representative of the Ohio Brass Company, Mansfield, Ohio, is making an extended tour throughout the Northwest.

E. A. Quinn, general superintendent of the San Joaquin Light & Power Company of Fresno, was a recent visitor at San Francisco.

C. D. Lamoree, salesman for the Westinghouse Electric & Manufacturing Company of Los Angeles, was a recent visitor at San Francisco.

W. C. Johnson, of the Westinghouse Electric & Manufacturing Company's San Francisco office, spent a few days at Terre Bella last week.

W. E. Camp, with the General Electric Company at Sacramento, was at San Francisco this week in regard to America's Electrical Week.

H. L. Jackman, manager of the Western States Gas & Electric Company, of Eureka, Cal., was a recent business visitor at San Francisco.

R. L. Eltringham, electrical engineer of the Industrial Accident Commission of California, is inspecting power systems in Southern California.

H. A. Barre, electrical and mechanical engineer for the Pacific Light & Power Company of Los Angeles, spent a few days this week at San Francisco.

J. H. McCarthy, formerly with the Electric Railway & Manufacturers' Supply Company, has recently returned to that company after spending a few months farming.

A. J. Myers, Pacific Coast manager of the Wagner Electric Company, will return to San Francisco about the first of the month, after an extended trip in Southern California.

J. S. Thompson, president of the Pacific Electric Manufacturing Company, has recently left San Francisco for a six weeks' trip to New York and other Eastern cities on business.

Eugenia Galvin, formerly electric range demonstrator for the Pacific Gas & Electric Company, has recently joined the sales force of the Western Auto Electric Company at Fresno, California.

B. J. Klein, Pacific district manager of the Bristol Company of Waterbury, Conn., gave an interesting talk at a meeting of the San Francisco purchasing agents' club last week on recording instruments.

F. H. Leggett, who has been Pacific Coast manager of the Western Electric Company during the past three years, will return to the company's executive offices in New York City after the first of the year.

F. D. Fagan, Pacific Coast manager of the Edison Lamp Department of the General Electric Company, will return to San Francisco about the first of the month, after four weeks' business trip throughout the Northwest.

Leoto Sol, with the department of agriculture of the Argentine Republic, is a recent visitor at San Francisco. He is here to investigate the possibilities of the manufacturers of the western coast doing business with his country.

R. M. Alvord, manager of the appliance department of the General Electric Company at San Francisco, who was recently married, will return to San Francisco from a short honeymoon about the first of the month, spent in Southern California.

N. P. Melnikoff, engineer attached to the cabinet of his Majesty, Emperor of Russia, and professor of the Electro-Technical Institute of the Emperor Alexander the Third, of Petrograd, Russia, is a recent visitor at San Francisco. He is spending a few months in the United States studying the possible electrical affiliations of the two countries.

E. J. Wallis will succeed **F. H. Leggett** on January 1st as Pacific Coast manager of the Western Electric Company. He is expected to be at San Francisco soon after the first of December. Mr. Wallis has been succeeded as manager of the company's southern district at Atlanta, Ga., by **F. B. Gleason,** formerly Pacific Coast manager and recently manager of the Western Electric Company's business in the Far East.

W. P. L'Hommedieu, of the Westinghouse Electric & Manufacturing Company; **S. J. Lisberger,** of the Pacific Gas & Electric Company; **W. A. Hillebrand,** of the Pacific Gas & Electric Company; **E. A. Quinn,** of the San Joaquin Light & Power Company, and **H. A. Barre,** of the Pacific Light & Power Company, had a meeting of the standardization committee of the N. E. L. A. for the purpose of standardizing transformer sizes and voltages, at San Francisco last week.

MEETING NOTICES.

Los Angeles Jovian League.

With John G. Monahan, district manager of the Sangamo Electric Company, as chairman of the day, the November 15th meeting was well up to the high standard set in the past. Cabaret entertainment was provided by the Andrews sisters, who told dialect stories and sang songs. John L. Butler, chief of police, spoke on "Police Problems and Their Solution."

Portland Meeting A. I. E. E.

The regular monthly meetings of the local sections of the American Institute of Electrical Engineers and Naitonal Electric Light Association, was held in the Auditorium of the Y. M. C. A., Portland, Oregon, Tuesday evening November 14th. Mr. Walter Haynes of the Y. M. C. A. Engineering School Faculty, presented a paper on "General Principles of Wireless Telegraphy and Telephony," with a demonstration of apparatus. Mr. L. T. Merwin was chairman of the meeting. After the meeting light refreshments were served. Seventy members were in attendance.

San Francisco Section A. I. E. E.

The section will meet at the Engineers' Club, November 24th, at which time three papers will be presented: 1. "A Study of Ceramics of Insulators," by Professor Harris J. Ryan; 2. "Progress Report On the Study by California Power Companies of Insulator Deterioration," by J. C. Clark; 3. "Investigation of Suspension Insulator Deterioration by California Power Companies," by J. E. Woodbridge and J. P. Jollyman. An excursion is being arranged to visit the laboratories at Stanford University, where the tests and experiments have been carried on in connection with the above, the plan being to leave San Francisco, Third and Townsend street station, at 1:20 p. m. Saturday, November 25th.

Electrical Development and Jovian League.

San Francisco's new aquarium was the subject of the league meeting on November 15th. With R. E Fisher as the chairman of the day, with fish as the main part of the menu and with the presence of the president of the Fish and Game Commission, the piscatorial features of the meeting were well cared for. Mr. Ignatz Steinhart, who will donate sufficient to build an aquarium, briefly introduced the subject, saying that the aquarium would be erected as a memorial to his deceased brother and that funds for its maintenance had been provided by the people passing an amendment at the last election. He presented Dr. B. W. Evermann who is in charge of the Academy of Science Building in Golden Gate Park. Dr. Evermann stated that an aquarium is a wonderful asset

for a city. He told of the peculiar climatic advantage at San Francisco and illustrated his remarks with a beautiful collection of lantern slides showing acquaria throughout the world as well as typical fish that may be found in the San Francisco aquarium. M. H. de Young urged that the quarium be built in Golden Gate Park, but the League did not take a vote on the question. T. E. Collins, Congressman of the Jovian Order, explained the need for an increase in the national Jovian dues and urged all members to continue their membership.

Pacific Coast N. E. L. A. Section.

R. H. Ballard, secretary and assistant general manager of the Southern California Edison Company and vice-president of the National Electric Light Association, has filed an application for authority to form a geographic section of the National Electric Light Association, which will undoubtedly be acted upon at the December meeting of the executive committee. This will be known as the Pacific Coast Section, and will embrace the states of California, Arizona, Nevada and New Mexico. When official sanction has been given this application, steps will be taken toward perfecting organization details and getting formally under way.

The Pacific Coast Section is the result of a growing and insistent demand among members of the National Electric Light Association in the West during the past few years for an association which would provide the benefits of the National Association and which, also, would be better able to cope with the conditions and problems peculiar to this section of the country. It will, therefore, be the object of the section to carry out the aims and purposes of the National Association, and, furthermore, extend to its members special privileges and advantages which the parent organization is unable to offer. It will also strive to bring about a closer affiliation between its members and afford a better medium for the exchange of opinions, experiences and conclusions regarding the many complex problems arising in the central station industry, many of which are not only of local interest, but of importance to the industry as a whole. Especially is this true in the development of the electrical business in the West.

The section will include in its membership the engineering and scientific professions, electricians, manufacturers, publishers, bankers and others interested in promoting the use of electricity, as well as central stations and their employes. The meetings and sessions will be held at points convenient of access to members, thus enabling the attendance of a large number who heretofore have found it impossible to attend the conventions of the national body and every encouragement will be given to members to participate in its sessions.

Geographic sections have been formed in different parts of the country, and conditions in the West seem to offer possibilities for even greater results than obtain in any other section. Applications for affiliation in the new section have been received from an exceedingly gratifying majority of the N. E. L. A. members in the above states, evidencing the strong sentiment in favor of the plan.

NOTES OF CALIFORNIA WATER COMMISSION.

The Paradise Irrigation District of Paradise, Butte County, organized March, 1916, has applied for permission to appropriate 19,600 acre feet, equivalent to 66 second feet, by the storage of flood waters of Butte Creek, to be used in the irrigation of the lands of the district, in Butte County. The storage and diversion dams are one and the same. The proposed dam specifications are given in the application as follows: 134 ft. high, 1250 ft. long on top, 710 ft. long on bottom, 20 ft. wide on top, constructed of earth, hydraulic fill, rock rip-rapped on face, loose rock or asphaltic concrete on back, concrete cut-off wall, concrete waste-way in natural rock at side. The main ditch or pipe line is given as 7600 ft. It is proposed to begin work in the summer of 1917 and complete in two years. The number of acres to be watered is 11,100, which are also involved in two other applications the district now has before the commission. The estimated cost of this diversion is given as $350,000.

A. L. Richardson of Placerville has applied for permission to appropriate 1½ cu. ft. per second of the waters of a creek flowing from Eagle Lake into Emerald Bay, tributary to Lake Tahoe, in Eldorado County. At a cost of $1200, applicant proposes to develop enough water for a hotel service and to operate a small electric plant for the hotel.

H. O. Kohler and A. Schwartz of Washington, Nevada County, have applied for permission to appropriate waters of Scotchman's Creek, tributary to South Yuba River. The proposed main ditch is two miles long, and there is a dam 10 ft. high, 35 ft. on top and 25 ft. on bottom, the works to cost $4725.

The Farm Land & Investment Company of San Francisco has applied for permission to appropriate 100 cu. ft. per second of the waters of the Yuba and Feather Rivers, tributary to the Sacramento River, in Yuba County, for the culture of rice. The proposed diversion is to be by means of one 24 in. and one 30 in. centrifugal pump electrically driven. The number of acres to be watered is 5500 and the estimated cost is $31,000. The same company, in a second application asks permission to divert an additional 200 second feet from the Feather River and Plumas and Messick Lakes, also tributary to the Sacramento River. A 24 in., 36 in. and 40 in. electric pumps are to be used in this diversion, for 8500 acres at a cost of $31,000.

The Twenty-One Mining Company of Phoenix, Arizona, has applied for permission to appropriate 1¼ cu. ft. per second of the waters of Grave: Tunnel, at the head of Buckeye Ravine, tributary to Kanaka Creek, in Sierra County, for mining and milling purposes. The water will be conducted to place of use by a pipe line 2100 ft. in length, and will be returned to Kanaka Creek after use.

NEW BULLETINS.

The Chicago Pneumatic Tool Company has just issued bulletins 266 and 130 on Railway Motor Cars and Lubrication of Pneumatic Tools.

Moloney Electric Company of St. Louis has published Booklet No. 160, illustrating and describing some installations of Moloney transformers throughout this country and Canada.

The General Electric Company has just issued the following new publications dealing with the subjects as listed: Bulletin No. 49300, Armored Cables; No. 48320, Speed-Regulating Rheostats and Panels for Direct Current Motors; No. 46104A, Type G Demand Meter; No. 46103A, Type M Demand Meters, and No. 46101A, Type P Demand Meters.

How far will a trolley car coast and how long will it take it to come to rest after the power is shut off? How quickly can the motorman stop his car by the use of brakes? How much current does it take to start an electric car? How fast will an electric car run under a given voltage of current? Does it take more or less current to run a car fast than slow? These questions and many others of a similar character have been studied by A. M. Buck of the Engineering Experiment Station of the University of Illinois and are answered in Station Bulletin No. 90 entitled "Some Graphical Solutions of Electric Railway Problems." Copies may be obtained gratis from W. F. M. Goss, Director, Urbana, Illinois.

TRADE NOTES.

The Westinghouse Electric & Manufacturing Company donated the use of a complete electric cooking equipment to the Cafe Belgique, which was recently held in conjunction with the Belgian relief work at the Exposition Auditorium, San Francisco.

NEWS NOTES

INCORPORATIONS.

POLSON, MONT.—The Valley View Telephone Company has been incorporated here.

IRVING, CAL.—The Union Telephone Company has been incorporated by W. Polders, C. P. Barnard, E. W. Zumwalt.

TACOMA, WASH.—The Sound Telephone & Telegraph Company has been incorporated with a capital stock of $10,000 by W. C. King, A. and M. Oholson.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Central Counties California Gas Company, with a capital stock of $500,000, by C. S. S. Forney, E. C. Hall, B. F. Silverstein, J. C. Wheeler, Jr., and W. M. Pigg. The incorporation of the new company is believed to be a preliminary move toward the acquisition of the Hanford Gas & Power Company by Forney and his associates, and it may lead to a consolidation of several San Joaquin Valley properties. Among other things a gas transmission main from Visalia to Hanford and thence to Armona and Lemoore in Kings County, is planned. A lateral branch from this main will serve Goshen, making a total of ten communities served in Tulare and Kings counties.

ILLUMINATION.

MYRTLE CREEK, ORE.—Bids will be received by the town recorder until December 5th for the construction of a water and light plant.

SUNNYSIDE, WASH.—Having been granted a 50-year franchise here the Pacific Power & Light Company has started changes in the lighting system.

FRESNO, CAL.—The trustees have accepted the bid of the Lewis Electric Company for the installation of an electrolier system on South I street. The bid was $9575.

BERKELEY, CAL.—The city council has decided to ask the Pacific Gas & Electric Company to install conduits at no expense to the city and place 14 lights on Adeline street between Woolsey and Ward streets.

MERCED, CAL.—A design for the electrolier standard and lamp has been selected and the city engineer will proceed to prepare plans and specifications for the system, which is to be installed in the business section.

WAPATO, WASH.—The town of Sunnyside has granted to the Pacific Power & Light Company a 50-year franchise and the company has changed its lighting system now under way; and will erect a new office building in Sunnyside.

ALHAMBRA, CAL.—The Pacific Light & Power Corporation is seeking a franchise for lighting purposes in Monterey Park. Some opposition has developed, but with a few slight changes in the proposed franchise, the trustees expect to adopt it.

LOS ANGELES, CAL.—The city council has instructed the board of public works and the city attorney to prepare and present an ordinance for the ornamental lighting of Beacon street, in the San Pedro District between Fourth and Sixth streets.

LOS ANGELES, CAL.—That the proposed new Broadway lighting system will cost in the neighborhood of $50,000 and that it will require six months for installation are announcements made by W. D'A. Ryan, electrical expert, who is planning the new system.

TACOMA, WASH.—The Pacific Telephone & Telegraph Company will start work soon in extending its service south of Forty-eighth street and west of Sheridan street, at a cost of $25,000. The work involves 136 poles and 20,000 ft. of aerial cable and miscellaneous underground work.

VISALIA, CAL.—The Mount Whitney Power & Electric Company has been awarded the contract for the construction of a system of ornamental street lights for West Main street from Encina avenue to the city limits, on its bid of $1450. Work is to be started within 30 days.

SEATTLE, WASH.—An ordinance authorizing the condemnation of three lots adjoining the city's steam auxiliary lighting plant to provide a site for a second unit has been passed by the council. The estimated cost of the second unit is $400,000. Authorization of a bond issue is necessary.

LOS ANGELES, CAL.—Bids will be readvertised by the board of public works for ornamental lighting posts and appliances for Adams street from Grand avenue to Figueroa street, as the bids received were considered too high. They are: F. O. Engstrum, $3818; John L. Wilson, $3867; and D. S. McEwan, $3950.

GLOBE, ARIZ.—At a meeting of the city council the question of a municipal lighting plant was revived when a report was made on a petition for an arc light at the corner of High and Apache streets, to the effect that it could not be granted because the plant of the Globe Light & Power Company is already taxed to capacity.

TRANSMISSION.

HOQUIAM, WASH.—The project to vote $175,000 bonds for the purchase or condemnation of the distributing system of the Grays Harbor Railway & Light Company in Hoquiam or the construction of a plant for the city, was defeated.

CASHMERE, WASH.—Mayor Jones and the city council are considering the calling of a public meeting to hear expressions from the taxpayers on the proposition of issuing bonds for the purpose of constructing a municipal power plant.

ANGELS, CAL.—A transmission line is to be built into the Pioneer shaft of the Angels Deep Mining Company from the San Francisco & Sierra Power Company's main line at Altaville at once, as a precautionary measure, should the Brown-Smyth-Ryland deal fail to materialize.

BOISE, IDAHO.—An application for a certificate of convenience and necessity has been made to the public utilities commission by J. E. Goodman of New Meadows to furnish electricity to the towns of Donnelly, Arling, Cascade and the incorporated villages of Roseberry and Van Wyck. The proposed plant and transmission lines would cost $12,000. The plant will be erected on the North Fork of the Payot River at Lardo.

TELEPHONE AND TELEGRAPH.

SANDPOINT, IDAHO.—Work will be commenced on the construction of sixteen miles of government telephone line to connect Moyle and Leona. The work will be under the supervision of J. A. Fitzwater.

OKANOGAN, WASH.—The Colville National Forest Department of Agriculture has applied to the Commissioners of Okanogan County for a franchise to construct telephone lines upon the county roads. The petition will be heard by the board of commissioners on December 5th.

MODESTO, CAL.—The territory including the country areas of the Modesto and Turlock irrigation district and the incorporated towns of Modesto and Turlock at the general election was constituted a public utility district for the express purpose of taking over all telephone lines and exchanges included in the area for operation as a municipal enterprise.

SALT LAKE CITY, UTAH.—The Mountain States Telephone & Telegraph Company plans to spend immediately in this district a total of $310,000, divided as follows: Murray, $120,000; Midvale, $112,000, and Holliday, $80,000. Three new exchange buildings, 110 miles of new poles and the

rejuvenation of an equal length of old time line poles, are included in the plans, according to C. C. Campbell, district manager.

FRESNO, CAL.—Authorization for more than $10,000 worth of improvements to the valley division of the Pacific Telephone & Telegraph Company has been made. The work will consist of a rebuilt toll lead between Modesto and Fresno and the installation of central office equipment here. The toll lead will cost approximately $6620. The central office work here will consist of switchboard apparatus to cost approximately $4930 and will be completed in about 150 days.

TRANSPORTATION.

LOS ANGELES, CAL.—Recommendation that the Los Angeles Railway be allowed to rebuild its Temple street line in sections will be made to the board of public utilities. If approved the company will probably ask for a new franchise, the old one having expired.

SEATTLE, WASH.—Seattle's municipal street railways continue to lose $2000 monthly, with a net loss of $1985.47 in October, reported by A. L. Valentine, superintendent of public utilities. Total expenses for the two divisions amount to $4410.90, as compared with $3965.38 revenue. A total of 58,004 passengers was carried. Since the city light department took over the street railway substations, the power cost is being checked against the value of the substations, so that in October the street railways received $1069.63 worth of power without cash outlay. The power cost added to the item of $1593.86 for bond interest charged against the railways exceeds the loss by $678.91. The interest payment, however, is checked against tax levy funds. The books of the municipal lines show more cash on hand now than last year.

IRRIGATION.

STOCKTON, CAL.—A contract to install a new pumping plant at the station on the east side of Yosemite Lake has been awarded to the Electric & Machine Equipment Company.

PORTERVILLE, CAL.—W. A. Kraner, of San Francisco, has been awarded the contract for the construction of the first unit of the Terra Bella irrigation district, to be completed by July 1, 1917, at a cost of $376,000.

MONTAGUE, CAL.—Work on the big pumping plant that is to take water from the Shasta River and irrigate the lands in Grenada district is now going on rapidly and the pumps will be working in time for next season.

VALE, ORE.—At the meeting of the board of directors of the Warm Springs Irrigation District, held recently, it was resolved unanimously to advertise the sale of the entire issue of $750,000. This will be done and the sale will take place late in December.

VICTORVILLE, CAL.—Landholders in the vicinity of Sheep Creek are planning to go ahead with an irrigation enterprise. It is believed a watershed in the vicinity of Sheep Creek will furnish a large amount of water. Estimates vary as to the amount which can be irrigated all the way from 15,000 acres to 50,000 acres. The project contemplates a dam about 1200 ft. long and 90 ft. high.

TWIN FALLS, IDAHO.—Louis C. Kelsey, consulting engineer, is now at Twin Falls, Idaho, making surveys of water supply, preliminary to preparing plans and recommendations covering the proposed extension to the municipal waterworks system contemplated in that city. It is expected that plans can be ready in February and actual work undertaken early next spring. The job is estimated to cost about $300,000. Mr. Kelsey will not be back in Portland until next month.

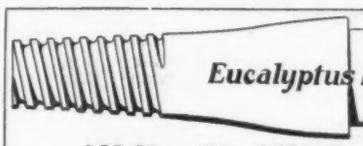
REDDING, CAL.—Professor T. H. Keans of Berkeley, an expert on irrigation, has been engaged by the directors of the Anderson-Cottonwood Irrigation District to estimate how much more money they need to complete the system. It has been evident for some time that the money derived from the sale of $480,000 in bonds would not be enough and because the price of materials has advanced so tremendously since the first estimates were made.

YUMA, ARIZ.—New plans are being made to unite Yuma and Imperial valleys in one reclamation service project, create a great storage dam and reservoir at Yuma with dam bulwarks to include Prison Hill, Yuma and Indian Hill, in California; spillway for waters to Mexican lands that would create vast electric energy and provide for power for pumping waters to mesa land and also for commercial purposes. The proposed project is estimated to cost from $20,000,000 to $25,000,000.

MADERA, CAL.—Actual work on the preliminary survey for the proposed Madera irrigation district will start at once, when Engineer Frank Clare and P. M. Stafford will take the field with a crew of men. Interest in the irrigation movement has been revived since the announcement was made that the negotiations with Miller & Lux had reached the stage where only the formal ratification of the tentative agreement was necessary to make it binding together with the surveying data which must be secured and presented before any action can be taken.

OAKDALE, CAL.—The Oakdale Irrigation District has partially solved its water shortage problem during the season of low water, and that without building a reservoir. A pumping plant will be installed, to handle the seepage with a 150 h.p. engine at the bridge, and this quantity of water will be lifted back into the canals for use a second time. It will cost about $600 to operate the plant during the month when the water is low. This will greatly relieve the pressure on the flow available from the river, and if the plan is successful, other pumping plants may be installed further down the river to make a third use of the irrigation water.

LEAHY OIL BURNERS hold the record
for Economy, Simplicity and Long Life
Thorough Atomization
No Back Pressure
Oil Feed at Right Angles to Steam — Best Regulation — *Write for Circular*
LEAHY MANUFACTURING CO.
8TH & ALAMEDA STREETS, LOS ANGELES, CAL.


Eucalyptus Insulator Pins
McGlauflin Mfg. Co. San Rafael, Cal.

The Schaw-Batcher Co. Pipe Works
(INCORPORATED)
Manufacturers of RIVETED IRON AND STEEL PIPE
Tanks of all descriptions for Water, Oil and Gas. Single and Double Well Casing
OUR SPECIALTY: Riveted Pipe for High Pressure
Engineers and Contractors for the complete installation of Pipe Lines used in the operation of Hydraulic Mines, Power Plants, Water Works, Irrigation, Reclamation, etc. We have special facilities for supplying general supplies for Mills, Mines, etc.
Office, 211 to 219 J Street Works, 15th and B Streets
SACRAMENTO, CAL.
San Francisco Office, 356 Market St. New York Office, 65 Reade St

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

A-1 American Ever-Ready Works of National Carbon Co
Los Angeles; 755 Folsom St., San Francisco; Seattle.

B-1 Baker-Joslyn Company..... 10
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco.

C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co..... 5
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 Cutler-Hammer Manufacturing Co..... 11
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill.

D-2 Dearborn Chemical Company..... 13
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Co..... 13
206-8-10 First St., (near Howard), San Francisco.

E-3 Electric Agencies Co.....
279-283 Minna St., San Francisco; 419-421 E. Third St., Los Angeles.

E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco.

E-5 Electric, Railway & Manufacturing Supply Co..... 13
34 Second St., San Francisco.

E-6 Electric Novelty Works.....
533 Mission St., San Francisco.

E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago.

F-3 Federal Sign System (Electric)..... 4
618 Mission St., San Francisco.

G-1 General Electric Co..... 12
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

H-1 Habirshaw Electric Cable Co., Inc.....
(See Western Electric Company.)

H-2 Hemingray Glass Co..... 13
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-3 Haller-Cunningham Electric Co..... 13
428 Market St., San Francisco.

H-4 Hubbard & Co..... 3
(See Pacific States Elec. Co.)

H-7 Hurley Machine Co..... 2
New York and Chicago. (See Pacific States Electric Co.)

I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles.

I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco.

L-1 Leahy Manufacturing Co..... 7
Eighth and Alameda St., Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 14
(See Pierson, Roeding & Co.)

M-2 McGlauflin Manufacturing Co..... 7
San Rafael, Cal.

M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco.

N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co.....
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco.

N-6 National Carbon Co.....
Cleveland, Ohio.

O-1 Okonite Co. (The)..... 14
(All Jobbers.)

P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 Pelton Water Wheel Co..... 13
2219 Harrison St., San Francisco.

P-5 Pierson, Roeding & Co..... 14
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-7 Pittsburgh Piping & Equipment Co..... 14
Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The..... 7
211 J St., Sacramento; 356 Market St., San Francisco.

S-4 Southern Pacific Co..... 5
Flood Bldg., San Francisco.

S-5 Sprague Electric Works..... 3
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815 Newhouse Bldg., Salt Lake City, Utah.

T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 Tubular Woven Fabric Company..... 10
Pawtucket, R. I.

U-1 United Sheet Metal Works.....
575 Howard St., San Francisco.

W-1 Wagner Electric Manufacturing Company.....
St. Louis, Mo.

W-2 Western Electric Co..... 5
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 Ward-Leonard Electric Co..... 14
Mt. Vernon, New York.

W-4 Westinghouse Electric & Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; First National Bank Bldg., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.)

W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.